



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/775,653	02/05/2001	Yuuichi Tachino	1076.1063 (JDH)	9294
21171	7590	06/30/2004	EXAMINER	
STAAS & HALSEY LLP SUITE 700 1201 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			CROWELL, ANNA M	
			ART UNIT	PAPER NUMBER
			1763	

DATE MAILED: 06/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/775,653

Applicant(s)

TACHINO ET AL.

Examiner

Michelle Crowell

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 March 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11-22 and 24-26 is/are pending in the application.
- 4a) Of the above claim(s) 1, 4-6, 8, 9, 11, 12, 15, 16, 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2, 3, 7, 13, 14, 17, 18, 21, 22, and 24-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3124/04
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Newly amended claim 11 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: claim 11 recites the new limitation of “the portion of the high frequency antenna is formed by twisting a plate having a uniform thickness and a uniform width by 90 degrees” which is directed to a nonelected species-Figure 10a. Election without traverse of Species I-Figure 1 was made on September 9, 2002.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claim 11 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 2, 3, 7, 21, and 22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 2 requires “performing plasma etching at a variable speed”. The

specification fails to disclose this feature. On page 8 , lines 2-4, the specification simply supports controlling the driver to move the coil relative to the reaction tube.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 2, 3, and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman et al. (U.S. 5, 879,575) in view of Okumura et al. (U.S. 5, 888,443).

Referring to Figures 5 and 6, column 6, lines 15-24, and column 7, lines 35-65, Tepman et al. discloses a plasma reactor 30 which performs etching. The reactor 30 includes a dielectric reactor ceiling 240 (reaction tube), an RF coil unit 150 and 270 (high frequency coil antenna) with multiple windings 152, 154, and 156 (winding portions) in parallel with each other, and a connecting rod 310 (drive mechanism). The reactor ceiling 100 may be cylindrically shaped or

Art Unit: 1763

other geometries suitable for plasma processing (col. 5, lines 65-67). The coil support 270 (sloped segment) is continuously formed between two of the plurality of winding portions 152, 154, and 156 in series, the sloped segment 270 is located closer outer peripheral surface of the reaction tube 240 than the plurality of winding portions 152, 154, and 156, and the sloped segment 270 is formed between a power supply terminal and a grounding terminal. The RF coil unit 150 and 270 is connected to ground at winding 152 and connected to a power supply source at 170. The RF coil unit 150 and 270 rotate around the reactor ceiling 100 by means of a connecting rod 310 (drive mechanism). When the RF coil is rotated around the reactor ceiling, the majority of the inner surface of the reactor vessel is cleaned (etched).

With respect to the limitation “when performing plasma etching”. This limitation refers to the intended use (etching) of the plasma apparatus which has no significance in the patentability of apparatus claims. A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Thiabault, 164 USPQ 666, 667 (Bd. App. 1969).

Tepman et al. fails to teach a **controller** connected to the drive mechanism to control a relative moving speed between the high frequency coil antenna and the reaction tube.

Referring to Figures 1 and 17, column 4, line 65-column 5, line5, and column 10, lines 5-10, Okumura et al. teaches that it is known to use a controller 100 to control the rotational speed of a coil 1 by controlling the stepping motor 3 (rotary actuator-drive mechanism). The coil 1 is connected to a stepping motor 3 via rotary shaft 4. By controlling the rotational speed of the coil, better control of the plasma density is achieved. Therefore, it would have been obvious to

Art Unit: 1763

one of ordinary skill in the art at the time of the invention to provide the rotational drive mechanism of Tepman et al. with the controller as taught by Okumura et al. since this would provide better control of the plasma density inside the chamber.

With respect to the limitation of “wherein the uniformly distributed capacitive coupling between the high frequency coil antenna and the reaction tube reduces a depositing rate of etching products to extend a cleaning interval for cleaning inner walls of the reaction tube”, it should be noted that claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. Thus, the apparatus of Tepman et al. in view of Okumura et al. provides the structural claim limitations and is capable of reducing a deposition rate of etching products to extend a cleaning interval for cleaning inner walls of the reaction tube.

7. Claims 13, 14, 18, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman et al. (U.S. 5,879,575) in view of Takada et al. (U.S. 5,525,379).

Referring to Figures 5 and 6, column 6, lines 15-24, and column 7, lines 35-65, Tepman et al. discloses a plasma etching apparatus comprising: an etching chamber 30 to accommodate a workpiece 130; a reaction tube 240 connected to the etching chamber, the reaction tube including an axis, an outer circumference, and being made of a dielectric material in the form of a cylinder (col. 6, lines 7-10, col. 5, lines 65-67); a coil antenna 150, 270 surrounding an outer wall of the reaction tube, the coil antenna including a first winding 152 extending around the outer circumference of the reaction tube at a first location along the axis of the reaction tube, a second winding 154 extending around the outer circumference of the reaction tube at a second location along the axis of the reaction tube, and an intermediate segment 270 continuously formed

Art Unit: 1763

between the first winding and the second winding in series; a plasma generating power supply 170 to supply high frequency power to the coil antenna; and a drive mechanism 310 to move at least one of the coil antenna and the reaction tube relative to the other to perform plasma etching on the workpiece, wherein the intermediate segment 270 is located closer to an outer peripheral surface of the reaction tube than the first winding and the second winding.

Tepman et al fails to teach the first and second winding extending only partially around the outer circumference of the reaction tube,

Referring to Figure 5a and column 5, lines 28-49, Takada et al. shows a plasma processing apparatus having a coil antenna 22 configuration including a sloped segment and first and second windings. The first and second winding extends only partially around the circumference of the reaction tube at a first and second location since this is a preferable structure for generating an RF electric field (col. 5, lines 28-35). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the coil antenna of Tepman et al. with the coil antenna as shown by Takada et al. since this is a preferable structure for generating an RF electric field.

Tepman et al. fails to teach the sloped segment wound around approximately one fourth the reaction tube and the winding wound around three fourths the reaction tube.

Referring to Figure 5a and column 5, lines 28-49, Takada et al. shows a plasma processing apparatus having a coil antenna 22 configuration including a sloped segment and two windings. The sloped segment is wound around approximately one fourth of a circumference of a peripheral surface of the reaction tube 21 and each winding is wound around approximately three-fourths of the circumference of the peripheral surface of the reaction tube since this is a

preferable structure for generating an RF electric field (col. 5, lines 28-35). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the coil antenna of Tepman et al. with the coil antenna as shown by Takada et al. since this is a preferable structure for generating an RF electric field.

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman et al. (U.S. 5,879,575) in view of Takada et al. (U.S. 5,525,379) as applied to claims 13, 14, 18, 21 and 22 above, and further in view of Okumura et al. (U.S. 5,888,413).

The teachings of Tepman et al. in view of Takada et al. have been discussed above.

Tepman et al. in view of Takada et al. fails to teach a controller.

Referring to Figures 1 and 17, column 4, line 65-column 5, line 5, and column 10, lines 5-10, Okumura et al. teaches that it is known to use a controller 100 to control the rotational speed of a coil 1 by controlling the stepping motor 3 (rotary actuator-drive mechanism). The coil 1 is connected to a stepping motor 3 via rotary shaft 4. By controlling the rotational speed of the coil, better control of the plasma density is achieved. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the rotational drive mechanism of Tepman et al. in view of Takada et al. with the controller as taught by Okumura et al. since this would provide better control of the plasma density inside the chamber.

9. Claims 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers et al. (U.S. 6,564,810) in view of Tepman et al. (U.S. 5,879,575).

Referring to Figures 1b, 2b, and 3b and column 4, line 36-column 5, line 38, Raaijmakers

Art Unit: 1763

et al. discloses an inductively coupled plasma processing apparatus comprising a cylindrical reaction tube 35 made of a dielectric material (col. 4, line 45); a single antenna 20 located around the reaction tube, the single antenna including: a first winding connected to a power supply; a second winding connected at a ground; a capacitive coupling segment continuously formed between the first winding and the second winding wherein the capacitive coupling segment and the second winding form a coil (col.4, lines 55-59).

Raaijmakers et al. fail to teach a drive mechanism to move at least one of the antenna and the reaction tube to the other to perform plasma etching.

Referring to Figure 5 and column 7, lines 37-47, Tepman et al. teaches a plasma processing apparatus including a drive mechanism 310 that moves at least one of the antenna 150 and the reaction tube relative to the other so that the section of an inner surface of the reactor adjacent to the coil changes with time and therefore the majority of the inner surface of the reactor vessel is cleaned. (col. 7, lines 61-65). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to include a drive mechanism to move at least one of the antenna and the reaction tube as taught by Tepman et al. in the apparatus of Raaijmakers et al. in order to clean the majority of the reaction tube's inner surface.

With respect the limitation of "when performing plasma etching". This limitation refers to the intended use (etching) of the plasma apparatus which has no significance in the patentability of apparatus claims. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Thiabault, 164 USPQ 666, 667 (Bd. App. 1969).

10. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers et al. (U.S. 6,564,810) in view of Tepman et al. (U.S. 5,879,575) as applied to claim 24 above, and further in view of Takada et al. (U.S. 5,525,379).

The teachings of Raaijmakers et al. in view of Tepman et al. have been discussed above.

Raaijmakers et al. in view of Tepman et al. fails to teach a segment is located closer to the tube than the first winding and the second winding.

Referring to Figure 5a, Takada et al. shows a plasma processing apparatus having an antenna coil 22 wherein a segment is located closer to the tube than the first winding and the second winding as a preferable structure for generating an RF electric field (col. 5, lines 28-35). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the antenna of Raaijmakers et al. in view of Tepman et al. with a segment located closer to the tube than the first winding and the second winding since it is a preferable structure for generating an RF electric field. Additionally, the configuration of the antenna is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed antenna was significant.

11. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers et al. (U.S. 6,564,810) in view of Tepman et al. (U.S. 5,879,575) as applied to claims 24 above, and further in view of Okumura et al. (U.S. 5,888,413).

The teachings of Raaijmakers et al. in view of Tepman et al. have been discussed above

Raaijmakers et al. in view of Tepman et al. fails to teach a **controller** connected to the drive mechanism to control a relative moving speed between the high frequency coil antenna and the reaction tube.

Referring to Figures 1 and 17, column 4, line 65-column 5, line5, and column 10, lines 5-10, Okumura et al. teaches that it is known to use a controller 100 to control the rotational speed of a coil 1 by controlling the stepping motor 3 (rotary actuator-drive mechanism). The coil 1 is connected to a stepping motor 3 via rotary shaft 4. By controlling the rotational speed of the coil, better control of the plasma density is achieved. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the rotational drive mechanism of Raaijmakers et al. in view of Tepman et al. with the controller as taught by Okumura et al. since this would provide better control of the plasma density inside the chamber.

With respect to the limitation of “wherein the uniformly distributed capacitive coupling between the high frequency coil antenna and the reaction tube reduces a depositing rate of etching products to extend a cleaning interval for cleaning inner walls of the reaction tube”, it should be noted that claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. Thus, the apparatus of Raaijmakers et al. in view of Tepman et al. and Okumura et al. provides the structural claim limitations and is capable of reducing a deposition rate of etching products to extend a cleaning interval for cleaning inner walls of the reaction tube.

Response to Arguments

11. Applicant's arguments with respect to claims 2, 3, 7, 13, 14, 17, 18, 21, 22, and 26 have been considered but are moot in view of the new ground(s) of rejection.

12. Applicant's arguments with respect to claims 24-25 have been fully considered but they are not persuasive.

Applicant has argued with respect to claim 24 that Tepman et al. fails to teach a single coil element. However, Raaijmakers et al. explicitly discloses a single coil element consisting of a first winding, a second winding, and a capacitive coupling segment. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). It should be noted that Tepman et al. was simply applied to teach a drive mechanism and not the coil configuration.

Applicant has argued that since the coil 20 of Raaijmakers et al. contacts the chamber the coil 20 does not include a capacitive coupling segment. However, claim 24 does not preclude the coil from touching the chamber surface. Additionally, it is well known to one of ordinary skill in the art that initially an RF coil excites a gas to generate plasma inductively, however capacitive coupling will occur between the coil and the plasma generated.

Art Unit: 1763

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Crowell whose telephone number is (571) 272-1432. The examiner can normally be reached on M-F (9:00 - 5:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (571) 272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1763

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AMC *me*
June 24, 2004

P. Hassanzadel
Primary Examiner
AU 1763